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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/674,871	09/29/2003	Steven R. Lowe	TUC920030101US1	6311
35825	7590	07/11/2006	EXAMINER	
LAW OFFICE OF DAN SHIFRIN, PC - IBM			THOMAS, SHANE M	
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ARVADA, CO 80004			PAPER NUMBER	

2186

DATE MAILED: 07/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/674,871

Applicant(s)

LOWE ET AL.

Examiner

Shane M. Thomas

Art Unit

2186

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 April 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11, 14-20 and 23-28 is/are rejected.
- 7) ☒ Claim(s) 12, 13, 21, 22, 29 and 30 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119


- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.

- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.


STEPHEN C. ELMORE
PRIMARY EXAMINER

DETAILED ACTION

Remarks

Examiner Shane Thomas has assumed the prosecution of this application henceforth.

This Office action is responsive to the response filed 4/5/2006. Claims 1-30 remain pending.

In the response to this Office action, the Examiner respectfully requests that support be shown for language added to any original claims on amendment and any new claims. That is, indicate support for newly added claim language by specifically pointing to page(s) and line numbers in the specification and/or drawing figure(s). This will assist the Examiner in prosecuting this application.

Excerpts from all prior art references cited in this Office action shall use the shorthand notation of [column # / lines A-B] to denote the location of a specific citation. For example, a citation present on column 2, lines 1-6, of a reference shall herein be denoted as "[2/1-6]."

Response to Arguments

Applicant's arguments, see response, filed 4/5/06, with respect to the rejections of claims 12,13,21,22,29, and under §112, second paragraph, claims 1,4,7-11,14,16-20, and 23-28 under §102(b), and claims 2,3,15, and 16 under §103(a) have been fully considered and are persuasive. Therefore, the rejections have been withdrawn. However, upon further consideration, new grounds of rejection is made in view of Lubbers et al. (U.S. Patent Application Publication No. 2003/0187847) and the "Microsoft Computer Dictionary."

Specification

The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

Claims 1-30 are objected to because of the following informalities:

As per claims 1 and 14, the term --plurality of ranks-- (claim 1, line 6; claim 14, line 5) should be amended to --plurality of logical ranks-- as the term --the plurality of ranks-- has not been previously defined in the claims. Further

Further regarding claim 1, the Examiner recommends amending the term --the corresponding rank-- to --a corresponding logical rank-- as the former term has not been previously defined in the claim.

Further regarding claim 1, line 13, the term --the destage mode-- should be amended to --the initial destage mode-- (or the like) as the term --the destage mode-- has not been previously defined in the claim.

As per claim 14, the Examiner recommends amending the phrase --that data update-- to --that each data update-- to clarify the claim language.

As per claims 14 and 23, the Examiner recommends amending the phrase --the corresponding rank-- to --a corresponding logical rank-- since the former term has not been previously defined in the claims.

Art Unit: 2186

Claims 2-13, 15-22, and 24-30 are objected to as being dependent on objected to base claims. Appropriate correction is required.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 23-30 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claims 23-30 are not limited to tangible embodiments. In view of applicants' disclosure, specification page 6, paragraph 17, the medium (i.e. the --computer program product--) is not limited to tangible embodiments, instead being defined as including both tangible embodiments (e.g. hard disk drives, floppy disks, optical storage, non-volatile devices, etc.) and intangible embodiments (e.g., "wireless transmission media, signals propagating through space, radio waves, infrared signals, etc"). As such, the claim is not limited to statutory subject matter and is therefore non-statutory.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 3,16, and 24, are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for “evaluating the available capacity of the NVS,” (§15 of Applicant’s originally-filed specification) does not reasonably provide enablement for “evaluating the capacity of the NVS” as claimed in the aforementioned claims. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims. The capacity itself is not taught as being evaluated during the evaluation of workload conditions, but rather the available capacity (§15). The scope of the limitation of “evaluating the capacity of the NVS” is not consistent with that of §15 of Applicant’s originally-filed specification in that the available capacity is checked (to determine if a backlog exists, for example). The capacity, itself, of the NVS would not change in accordance with the teachings of the Applicant’s originally-filed specification as the NVS is not taught to increase or decrease the amount of storage space it comprises. However, the available capacity does change as write data is written to the NVS before being destaged to the storage devices (§15 of specification). Nonetheless, for the purposes of examination, the Examiner has considered the limitation of claim 3 to evaluate the available capacity of the NVS when the evaluation of workload conditions occurs.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1,3,4,7-11,14-20, and 23-28, are rejected under 35 U.S.C. 102(e) as being anticipated by Lubbers et al. (U.S. Patent Application Publication No. 2003/0187847).

As per claims 1,14, and 23, Lubber teaches embodiments of a **method** (§§79-82), a **storage control unit** (figure 5), and a **computer program product** (§13), for **allocating a predetermined portion of a temporary storage** (1100 - figure 11) **to each of the plurality of [logical] ranks** (figure 11 shows corresponding portions of a command region 1110 and a data region 1130 for each --logical rank-- or logical block address (LBA)); **establishing an initial destage mode** (§79 - catch-up ratio) **whereby data is destaged from a portion of the temporary storage** (data log 1100 - §86) **to the corresponding rank [logical rank]** (merge I/O writes out of the data log 1100 - §80 - which are written to the destination block address of the destination site - §79) **at a predetermined rate relative to the rate at which host write requests are processed and stored in the temporary storage** 1100 (§81); **destaging a data update** (i.e. any corresponding pair of entries in the command region 1110 and data region 1130 (§86)) **from the temporary storage 1100 to the target rank** (i.e. destination LBA of the destination storage system - §80); **evaluating workload conditions of the temporary memory** 1100 (monitoring the ratio of logging writes to merging writes - §80 - or in other words, the ratio

Art Unit: 2186

of write I/Os out of the data log to host write I/Os into the data log); and **modifying the destage mode in response to the evaluation** (this is an inherent step of Lubbers as it can be seen that in order to keep the ratio of incoming host writes to destaging writes to the destination storage within a desired range, a modification to the destage mode, or the rate in which data updates are destaged, would have to be performed in order to maintain the ratio when, for example, many incoming I/O writes from a host are received in a short span occurs.)

As per claims 3, 16, and 24, Lubbers teaches **evaluating the [available] capacity of the NVS** (i.e. the portion of the disk containing the data log file - see abstract for teaching that the data log is stored on a disk and therefore the data file is non-volatile) - ¶80 (where the ratio is maintained as long as the data file is a predetermined size). Lubbers further teaches a procedure for compensating for when a log becomes filled (¶82).

As per claims 4, 9, 19, and 27, Lubbers inherently teaches **determining if the temporary storage 1100 is receiving host write requests faster than stored data updated are [being] destaged** as Lubbers teaches monitoring the ratio of logging writes to merge writes (writes stored to the log from the host to writes written to the destination storage device from the log) in ¶¶80-81. In order for this ratio to remain constant, as more writes are logged into the data log 1100, the rate at which the merge writes are destaged from the data log and sent to the destination storage device must inherently increase as well. Coincident, with the Applicant's definition, the Examiner is considering the raising of the destage rate by the system of Lubbers when an increase of incoming write I/Os occurring to the data log by a host (¶80) to be as a result of the detection of a possible **backlog** or overflow condition. This can be seen with aid from the following example. The Host 1 102 of Lubbers' figure 5 at a certain point in time increases its

Art Unit: 2186

write I/O operations to the data log 1100 (§79), and the system that monitors the ratio of logging writes from the host to the merging writes to the destination storage device (§80) must detect this increase in host writes I/O operations. Increasing a number of host I/Os may lead to a backlog (or log fill - §82); therefore, in order to maintain the ratio as taught in §81, the system of Lubbers detects that a backlog (i.e. overflow of the log as discussed in §82) could be created and corrects the imbalance by increasing the rate of merging writes to the destination storage device, thereby maintaining the correct ratio of logging writes to merging writes - §81.

As per claims 7, 17, and 25, the Examiner is considering the --evaluation of workload conditions-- to be the collection of all processes the system of Lubbers uses when implementing a data log when a failure occurs to a storage site (§§75-76). One of these processes is the process of throttling the rate of merging writes as previous discussed above (§§80-81). Another of these processes is taught in §§84-85, where the system must determine if more than one destination system is to receive the merged writes from the data log. Because of the physical distance between the possible destination storage systems (Japan, Houston, etc.) and the storage system that contains the data log (Colorado), the Examiner is considering the method in which the backup processing occurs by destaging the data log data from the Colorado system to any destination systems as taught in §85 to be --long path-length processing--. The **evaluation of the long-path length processes** occurs when source storage system containing the data log (i.e. Colorado) evaluates when and how to implement and restart the “merge fence” process of the recovery process as described in §85. Therefore, it can be seen that in response to the evaluation of workload conditions (which comprise the rate of incoming host writes as previously discussed above with reference to claims 1, 14, and 23) the recovery/fail-over system of Lubbers teaches

Art Unit: 2186

evaluating a long path-length processes when destaging the data log writes to multiple destination storage systems.

As per claims 8, 18, and 26, Lubbers inherently teaches **the initial destage mode can be 0 where no correlation is present between the number of destages required before a new write request is processed**. Such a limitation can be seen as being inherent with respect to Lubbers as when the data log is empty just before the first incoming write I/O is received from the host. If no write has yet to have been received into the data log 1100, then it is inherent that at that point in time no ratio exists between the number of writes I/Os written to the data log against the number of write I/O that are merges into the destination storage system.

As per claims 10, 20, and 28, Lubbers teaches **modifying the destage mode** (from 0, or default) **to 1 if a backlog is in danger of being created** (§80-82). In order to prevent a backlog (i.e. data log becoming filled), a catch-up ratio is implemented as discussed throughout this action (§79) to destage the write I/Os from the data log to the destination storage system in a timely manner. Thus, it can be seen that before the data log has a chance to become filled, the system of Lubbers, via monitoring the ratio of incoming writes to destaging writes, performs the processes of destaging the writes from the data log to the destination storage system (§81). This ratio may be at or maintained at a level greater than 1:1 - §81.

As per claim 11, **evaluating whether a backlog is present** is taught in §82 of Lubbers as a determination regarding whether or not the data log is filled occurs.

As per claim 15, Lubbers teaches **the temporary storage 1100 comprising non-volatile storage memory (NVS)** as the data log may be contained on a disk (§12, §2), which is well known in the art to be non-volatile storage.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 2 rejected under 35 U.S.C. 103(a) as being unpatentable over Lubbers et al. (U.S. Patent Application Publication No. 2003/0187847), as applied to claims 1,3,4,7-11,14-20, and 23-28 above, in view of "Microsoft Computer Dictionary" (herein *Microsoft*).

As per claim 2, Lubbers teaches **the temporary storage** (i.e. the disk comprising the data log as discussed above) **comprising a non-volatile storage memory** (the portion of which contains the data log as discussed in the abstract and ¶12) **and destaging a data update comprises destaging the data update from the NVS - ¶¶79-81** - as discussed above. However, Lubbers does not specifically teach **the temporary storage comprising a cache memory**. *Microsoft* teaches that a disk cache is commonly used in conjunction with disks in order to access stored data considerable faster than if the program waited to fetch the information from the disk surface. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have combined the temporary storage of Lubbers (i.e. disk drive comprising the data log) with the disk cache teaching of *Microsoft* in order to have been able to have accessed data contained in the data log considerably faster when writing to the data log (during a incoming write I/O from a host) and when destaging the data from the data log to a destination storage system.

Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lubbers et al. (U.S. Patent Application Publication No. 2003/0187847), as applied to claims 1,3,4,7-11,14-20, and 23-28, above.

As per claim 5, Lubbers does not specifically teach **the initial destage mode comprising a destage write ratio of 3**; however upon consulting Applicant's originally-filed specification (§15, page 5) having the destage mode set to a ratio of three is not discusses as having a particular advantage, used for a particular purpose, or used to solve a stated problem with preventing or reducing a backlog of staged writes. The prior art of Lubbers teaches using a destage ratio of 4 (§81), and it appears that the claimed invention of the Applicant would have performed equally well with this feature of Lubbers (ratio of 4 instead of 3, as claimed). As such claim 5 is obvious as being a matter of *design choice*.

As per claim 6, the Lubbers teaches that the **modified destage mode** can have a **write request ratio of less than 3** as the ratio can be preferably any ratio at or above 1:1 (§81).

Allowable Subject Matter

Claims 12,13,21,22,29, and 30 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

As per claims 12,21, and 29, the prior art of record does not teach or suggest, either alone or in combination changing the destage mode to a ratio of 3 if a backlog is present. Specifically, with respect to the applied prior art reference of Lubbers, Lubbers teaches detecting a backlog

Art Unit: 2186

(data log becoming filled - ¶82) but does not teach or suggest changing the write request ratio to 3 based on that detection.

Claims 13, 22, and 30 are objected to as being dependent on an objected base claim.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Blount et al. (U.S. Patent Application Publication No. 2004/0255026) teaches dynamically changing thresholds for each rank of a RAID system.

Aref et al. (U.S. Patent No. 6,023,720) teaches a cache 34 and a NVS 51 to store write requests and can change the rate at which the write requests are destaged to disk 36 (steps 66-76 of figure 4).

Swenson et al. (U.S. Patent No. 5,544,343) teaches a caching system for a storage system capable of throttling the destage rate - figure 3.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shane M Thomas whose telephone number is (571) 272-4188. The examiner can normally be reached M-F 8:30 - 5:30.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matt M Kim can be reached at (571) 272-4182. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2186

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Shane M. Thomas


STEPHEN C. ELMORE
PRIMARY EXAMINER